



# GEOS7721

## Scientific Visualisation and Scripting

Session 2, Weekday attendance, North Ryde 2020

*Department of Earth and Environmental Sciences*

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#### Disclaimer

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#### Notice

As part of [Phase 3 of our return to campus plan](#), most units will now run tutorials, seminars and other small group learning activities on campus for the second half-year, while keeping an online version available for those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face and online activities for your unit, please go to [timetable viewer](#). To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

## General Information

Unit convenor and teaching staff

Steven Hansen

[steven.hansen@mq.edu.au](mailto:steven.hansen@mq.edu.au)

Credit points

10

Prerequisites

Admission to MRes

Corequisites

Co-badged status

GEOS8821

Unit description

In this hands-on, tutorial-style unit students will work with big data, learning how to manipulate, process and display large geoscience datasets using sophisticated scientific visualization programs. Topics covered include an introduction to programming using Matlab and Python, developing maps and processing digital elevation data, rendering and animation, managing and processing large datasets, algorithms in earth and environmental Science - including for statistical analysis and filtering, machine learning and clustering approaches, and visualisation of data. Students work through tutorial modules and also produce a final project using a dataset of their choosing. This unit is suitable for students at all levels of programming, and outside of Earth and Environmental Sciences, particularly those developing research skills using big data or geospatial analysis.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** demonstrate an understanding of basic computing algorithms, structures, and variables commonly used in scientific computing

**ULO2:** manipulate and process scientific data using Matlab and Python scripts

**ULO4:** develop coding strategies to solve problems and evaluate ideas and information

**ULO3:** apply fundamental concepts of data visualization to scientific datasets

**ULO5:** clearly present scientific data and scripting results, and apply supporting evidence to evaluate underlying hypotheses

## General Assessment Information

### Assessment Criteria

Assessment at Macquarie University is standards-based, as outlined in the [Assessment Policy](#). This means that your work will be assessed against clear criteria, and these criteria (e.g. in a rubric) will be made available when the assessment tasks are released to you on iLearn.

### Submission of Assessments

All assessments must be submitted online through [Turnitin](#) unless otherwise indicated. Links for the submission of each assessment will be available on [iLearn](#).

You should always check that you have uploaded the correct file. If you have a problem, please email the Unit Convenor with your correct file. You must also keep a copy of your assessments until the end of semester in case there is a problem with your submission. It is your responsibility to ensure that you can provide a copy of your assessment if requested.

### Marking of Assessments

Assignments will usually be marked through Turnitin with grades provided through Gradebook on iLearn. Please do not submit your assessments via email or in hard copy unless requested (e.g. a sketch or drawing).

We aim to return your assessment grades and feedback within two to three weeks of the date that you submitted it. We appreciate your patience and will advise you through iLearn when your marked assessments and feedback are available for viewing.

### Penalties for Late Assessments

The penalty for late submission of assessments in this unit is **ten percent (10 %) of the assessment value per day**, calculated from the due time and date. This means that if the assignment is worth a total of 30 marks (or 30 % of the unit) you will lose 3 marks for each day it is late. This is a hefty penalty designed to make you aware of the importance of organising yourself around assessment due dates. The penalty will be applied over weekdays and weekends unless you have been granted an extension prior to the due date.

### Extensions for Assessments

To obtain an extension for an assessment task, you will need to follow the formal process as outlined in the [Special Consideration Policy](#), and you must provide appropriate supporting evidence (e.g. medical certificate - see advice for [Special Consideration](#) requests). The final decision regarding the granting of an extension lies with the unit convenor. Permission for extensions must be sought **before the due date** unless there are exceptional circumstances. Please let us know of problems in advance or as soon as possible, not after the event. We are likely to be much more sympathetic and able to accommodate your circumstance if you follow this advice.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Basics of coding</a>	15%	No	Week 5
<a href="#">Python Assignment</a>	15%	No	Week 10
<a href="#">Data analysis report</a>	40%	No	Week 13
<a href="#">Open book test</a>	30%	No	TBD

### Basics of coding

Assessment Type [1](#): Problem set

Indicative Time on Task [2](#): 15 hours

Due: **Week 5**

Weighting: **15%**

Use the basic elements of programming to solve some problems.

On successful completion you will be able to:

- demonstrate an understanding of basic computing algorithms, structures, and variables commonly used in scientific computing
- manipulate and process scientific data using Matlab and Python scripts
- develop coding strategies to solve problems and evaluate ideas and information
- apply fundamental concepts of data visualization to scientific datasets

### Python Assignment

Assessment Type [1](#): Problem set

Indicative Time on Task [2](#): 15 hours

Due: **Week 10**

Weighting: **15%**

Use the concepts introduced in the Python module to solve a problem set

On successful completion you will be able to:

- manipulate and process scientific data using Matlab and Python scripts

- develop coding strategies to solve problems and evaluate ideas and information
- apply fundamental concepts of data visualization to scientific datasets

## Data analysis report

Assessment Type <sup>1</sup>: Project

Indicative Time on Task <sup>2</sup>: 60 hours

Due: **Week 13**

Weighting: **40%**

A 20-30 page report describing the methods and results of the data processing project. The report includes scientific figures and a full analysis of the chosen topic.

On successful completion you will be able to:

- manipulate and process scientific data using Matlab and Python scripts
- develop coding strategies to solve problems and evaluate ideas and information
- apply fundamental concepts of data visualization to scientific datasets
- clearly present scientific data and scripting results, and apply supporting evidence to evaluate underlying hypotheses

## Open book test

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 10 hours

Due: **TBD**

Weighting: **30%**

A take-home exam will involve the visualization of a dataset using the techniques developed in the course, and a short report.

On successful completion you will be able to:

- demonstrate an understanding of basic computing algorithms, structures, and variables commonly used in scientific computing
- manipulate and process scientific data using Matlab and Python scripts
- develop coding strategies to solve problems and evaluate ideas and information
- apply fundamental concepts of data visualization to scientific datasets
- clearly present scientific data and scripting results, and apply supporting evidence to

evaluate underlying hypotheses

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

### Unit iLearn

This unit has an iLearn page that can be accessed through [ilearn.mq.edu.au](http://ilearn.mq.edu.au). It contains important information and other materials relating to the unit, including details and links for assessments.

### Communication

The unit iLearn is the primary way that we communicate with you. Please check it regularly for announcements and posts. You are encouraged to use the Discussion Board on iLearn to post questions and generate discussion with other students. Please only email the convenor with private matters – all other questions should be posted on iLearn.

### Unit Organisation

This unit is delivered in **(weekly topics)**. The organisation of these is outlined in a detailed unit schedule which is available on [iLearn](#).

### Classes

This is a tutorial-based unit and the material presented as the course progresses. Weekly 2 hour drop-in sessions will be used to work through issues, meeting times will be determined in the first week.

### Workload

The expected workload for this 10-credit point unit is 150 hours of activity, comprising **XXXXX**.

### Requirements to complete this unit satisfactorily

To complete this unit satisfactorily, you must:

1. Complete all assessments and the open book exam; and
2. Achieve a pass grade or higher.

The descriptions for grades common to all coursework units offered by Macquarie University are outlined in [Schedule 1 of the Assessment Policy](#).

## Recommended Texts and/or Materials

There is no set textbook for this unit, but a number of reference texts worth considering are:

Head First Python, Paul Barry, O'Reilly, 2011

Matlab : A Practical Introduction to Programming and Problem Solving, Attaway, Stormy, 2009

## Technology Used and Required

You will need access to a computer, preferably a laptop, to run and develop code for this unit.

This unit will use iLearn and Echo360. See the [Instructions on how to log in to iLearn](#) and the [iLearn quick guides for students](#) which will help you:

- [Getting started](#) - Find out how to navigate and familiarise yourself with the iLearn environment
- [Activities](#) - Learn how to effectively complete the activities required of you in iLearn
- [Assignments and Gradebook](#) - Find out how to submit assessments and view your grades using iLearn
- [Online study tips](#) - Studying online is a unique experience, learn how to navigate it here
- [Discussion forums](#) - Explore the different types, and features of discussion forums in iLearn
- [Lecture recordings](#) - Find out how to access lectures online, as well as the features available to you

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Students seeking more policy resources can visit the [Student Policy Gateway \(https://students.mq.edu.au/unit\\_offerings/123012/unit\\_guide/print\)](https://students.mq.edu.au/unit_offerings/123012/unit_guide/print)

[mq.edu.au/support/study/student-policy-gateway](http://mq.edu.au/support/study/student-policy-gateway)). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/study/getting-started/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- [Getting help with your assignment](#)
- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)



## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.